110> APPLICANT: KUWABARA, YOKO
    HASHIGUCHI, Kenichi
    NAKAMATSU, Tsuyoshi
    KURAHASHI, Osamu
    MORI, Yukiko
    ITO, Hisao
120> TITLE OF INVENTION: CARBAMOYL-PHOSPHATE SYNTHETASE GENE OF CORYNEFORM
    BACTERIA AND METHOD FOR PRODUCING L-ARGININE
130> FILE REFERENCE: OP945CIP
140> CURRENT APPLICATION NUMBER: US/09/629,616
141> CURRENT FILING DATE: 2000-07-31
160> NUMBER OF SEQ ID NOS: 7
170> SOFTWARE: PatentIn Ver. 2.0

210> SEQ ID NO 1
211> LENGTH: 4837
212> TYPE: DNA
213> ORGANISM: Brevibacterium lactofermentum
220> FEATURE:
221> NAME/KEY: CDS
222> LOCATION: (283)..(1461)
221> NAME/KEY: CDS
222> LOCATION: (1470)..(4808)
400> SEQUENCE: 1

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      ccatttgagg gccaggaatt cagcgctaag gtcacacaca ccgtgcttcg tggcaaggtg 120
      acttgtgcag acggagttgc gcaagacgct taacgggtgg gtgcatagta tgcacgcgcc 180
      gcattgcata taatgcaatg aattgaataa actagattca gggttatcaa ccagccaatt 240
      tcttttaaaa agacagacac acgaaaggcg acaacagtca cc gtg agt aaa gac     294
                                                    Val Ser Lys Asp
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      acc acc acc tac cag gga gtc acc gag atc gga tcc gtt ccg gca tac  342
      Thr Thr Thr Tyr Gln Gly Val Thr Glu Ile Gly Ser Val Pro Ala Tyr
       5                  10                  15                  20
      ctg gtt ctt gca gac gga cgt acc ttc acc gga ttt ggc ttt gga gct  390
      Leu Val Leu Ala Asp Gly Arg Thr Phe Thr Gly Phe Gly Phe Gly Ala
                  25                  30                  35
      atc ggc acc acc ctt ggt gag gca gtg ttc acc acc gcc atg acc ggt  438
      Ile Gly Thr Thr Leu Gly Glu Ala Val Phe Thr Thr Ala Met Thr Gly
          40                  45                  50
      tac caa gaa acc atg acc gat cct tcc tat cac cgc cag att gtt gtg  486
      Tyr Gln Glu Thr Met Thr Asp Pro Ser Tyr His Arg Gln Ile Val Val
                  55                  60                  65
      gct acc gca cca cag atc ggt aac acc ggc tgg aac gat gag gac aac  534
      Ala Thr Ala Pro Gln Ile Gly Asn Thr Gly Trp Asn Asp Glu Asp Asn
          70                  75                  80
      gag tcc cgc gac ggc aag att tgg gtt gca ggc ctt gtt atc cgc gac  582
      Glu Ser Arg Asp Gly Lys Ile Trp Val Ala Gly Leu Val Ile Arg Asp
       85                  90                  95                 100
      ctc gca gca cgt gtg tcc aac tgg cgc gcc acc acc tcc ttg cag cag  630
      Leu Ala Ala Arg Val Ser Asn Trp Arg Ala Thr Thr Ser Leu Gln Gln
                  105                 110                 115
      gaa atg gca gac caa ggc atc gtc ggc atc ggc gga atc gac acc cgc  678
      Glu Met Ala Asp Gln Gly Ile Val Gly Ile Gly Gly Ile Asp Thr Arg
                  120                 125                 130
      gca ctg gtt cgc cac ctg cgc aac gaa ggt tcc atc gca gcg ggc atc  726
      Ala Leu Val Arg His Leu Arg Asn Glu Gly Ser Ile Ala Ala Gly Ile
                  135                 140                 145
      ttc tcc ggc gct gac gca cag cgc cca gtt gaa gaa ctc gta gag atc  774
      Phe Ser Gly Ala Asp Ala Gln Arg Pro Val Glu Glu Leu Val Glu Ile
          150                 155                 160
      gtc aag aat cag cca gca atg acc ggc gca aac ctc tcc gtt gag gtc  822
      Val Lys Asn Gln Pro Ala Met Thr Gly Ala Asn Leu Ser Val Glu Val
      165                 170                 175                 180
      tct gct gat gaa acc tac gtc atc gaa gct gag ggc gaa gag cgc cac  870
      Ser Ala Asp Glu Thr Tyr Val Ile Glu Ala Glu Gly Glu Glu Arg His
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               185                    190                    195
acc gtc gtg gcc tac gac ctg ggc att aag caa aac acc cca cgt cgt   918
Thr Val Val Ala Tyr Asp Leu Gly Ile Lys Gln Asn Thr Pro Arg Arg
               200                    205                    210
ttc tct gca cgc ggt gtt cgc acc gtc atc gtg cct gct gaa acc cca   966
Phe Ser Ala Arg Gly Val Arg Thr Val Ile Val Pro Ala Glu Thr Pro
               215                    220                    225
ttg gag gac atc aag cag tac aac cca tca ggc gtg ttt atc tcc aat  1014
Leu Glu Asp Ile Lys Gln Tyr Asn Pro Ser Gly Val Phe Ile Ser Asn
               230                    235                    240
ggc cct ggc gac cct gca gca gca gac gtc atg gtt gat atc gtc cgc  1062
Gly Pro Gly Asp Pro Ala Ala Ala Asp Val Met Val Asp Ile Val Arg
245                    250                    255                    260
gaa gtt ctg gaa gcc gac att cca ttc ttt ggc atc tgc ttc ggc aac  1110
Glu Val Leu Glu Ala Asp Ile Pro Phe Phe Gly Ile Cys Phe Gly Asn
               265                    270                    275
cag atc ctc ggc cgc gca ttc ggc atg gag acc tac aag ctg aag ttc  1158
Gln Ile Leu Gly Arg Ala Phe Gly Met Glu Thr Tyr Lys Leu Lys Phe
               280                    285                    290
ggc cac cgc ggc atc aac gtt cca gtg aag aag cac atc acc ggc aag  1206
Gly His Arg Gly Ile Asn Val Pro Val Lys Asn His Ile Thr Gly Lys
               295                    300                    305
atc gac atc acc gcc cag aac cac ggc ttc gca ctc aag ggt gaa gca  1254
Ile Asp Ile Thr Ala Gln Asn His Gly Phe Ala Leu Lys Gly Glu Ala
310                    315                    320
ggc cag gaa ttc gag aca gat ttc ggc act gcg att gtc acc cac acc  1302
Gly Gln Glu Phe Glu Thr Asp Phe Gly Thr Ala Ile Val Thr His Thr
325                    330                    335                    340
tgc ctt aac gac ggc gtc gtt gaa ggt gtt gcg ctg aag tcc gga cgc  1350
Cys Leu Asn Asp Gly Val Val Glu Gly Val Ala Leu Lys Ser Gly Arg
               345                    350                    355
gca tac tcc gtt cag tac cac cca gag gcc gct gcc ggc cca aat gat  1398
Ala Tyr Ser Val Gln Tyr His Pro Glu Ala Ala Ala Gly Pro Asn Asp
               360                    365                    370
gca agc ccc ctg ttt gac cag ttt gtt gag ctg atg gat gca gac gct  1446
Ala Ser Pro Leu Phe Asp Gln Phe Val Glu Leu Met Asp Ala Asp Ala
               375                    380                    385
cag aag aaa ggc gca taaataac atg cca aag cgt tca gat att aac cac  1496
Gln Lys Lys Gly Ala          Met Pro Lys Arg Ser Asp Ile Asn His
               390                        1                    5
gtc ctc gtc atc ggt tcc ggc ccc atc gtc att ggc cag gca tgt gaa  1544
Val Leu Val Ile Gly Ser Gly Pro Ile Val Ile Gly Gln Ala Cys Glu
10                    15                    20                    25
ttc gac tac tcc ggc acc cag gct tgc cgc gtg ctg aag gaa gag gga  1592
Phe Asp Tyr Ser Gly Thr Gln Ala Cys Arg Val Leu Lys Glu Glu Gly
                    30                    35                    40
ctg cgc gtc acc ctc atc aac tcc aac cca gca acg atc atg acc gac  1640
Leu Arg Val Thr Leu Ile Asn Ser Asn Pro Ala Thr Ile Met Thr Asp
                    45                    50                    55
cca gaa atg gct gac cac acc tac gtg gag cca atc gag ccg gaa tac  1688
Pro Glu Met Ala Asp His Thr Tyr Val Glu Pro Ile Glu Pro Glu Tyr
               60                    65                    70
atc gac aag att ttc gct aag gag atc gag cag ggc cac cca atc gac  1736
Ile Asp Lys Ile Phe Ala Lys Glu Ile Glu Gln Gly His Pro Ile Asp
               75                    80                    85
gcc gtc ctg gca acc ctt ggt ggc cag act gca ctt aac gca gct atc  1784
Ala Val Leu Ala Thr Leu Gly Gly Gln Thr Ala Leu Asn Ala Ala Ile
90                    95                    100                   105
cag ctg gat cgc ctc ggc atc ctg gaa aag tac ggc gtt gaa ctc atc  1832
Gln Leu Asp Arg Leu Gly Ile Leu Glu Lys Tyr Gly Val Glu Leu Ile
                    110                   115                   120
ggt gca gac atc gat gcc att gag cgc ggc gaa gat cgc cag aag ttc  1880
Gly Ala Asp Ile Asp Ala Ile Glu Arg Gly Glu Asp Arg Gln Lys Phe
               125                   130                   135
aag gat att gtc acc acc atc ggt ggc gaa tcc gcg cgt tcc cgc gtc  1928
Lys Asp Ile Val Thr Thr Ile Gly Gly Glu Ser Ala Arg Ser Arg Val
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              140                  145                  150
tgc tac aac atg gac gaa gtc cat gag act gtc gca gaa ctt ggc ctt   1976
Cys His Asn Met Asp Glu Val His Glu Thr Val Ala Glu Leu Gly Leu
    155                  160                  165
cca gta gtc gtg cgt cca tcc ttc act atg ggt ggc ctg ggc tcc ggt   2024
Pro Val Val Val Arg Pro Ser Phe Thr Met Gly Gly Leu Gly Ser Gly
170                  175                  180                  185
ctt gca tac aac acc gaa gac ctt gag cgc atc gca ggt ggc gga ctt   2072
Leu Ala Tyr Asn Thr Glu Asp Leu Glu Arg Ile Ala Gly Gly Gly Leu
                190                  195                  200
gct gca tct cct gaa gca aac gtc ttg atc gaa gaa tcc atc ctt ggt   2120
Ala Ala Ser Pro Glu Ala Asn Val Leu Ile Glu Glu Ser Ile Leu Gly
                205                  210                  215
tgg aag gaa ttc gag ctc gag ctc atg cgc gat acc gca gac aac gtt   2168
Trp Lys Glu Phe Glu Leu Glu Leu Met Arg Asp Thr Ala Asp Asn Val
                220                  225                  230
gtg gtt atc tgc tcc att gaa aac gtc gac gca ctg ggc gtg cac acc   2216
Val Val Ile Cys Ser Ile Glu Asn Val Asp Ala Leu Gly Val His Thr
                235                  240                  245
ggc gac tct gtc acc gtg gca cct gcc ctg acc ctg act gac cgt gaa   2264
Gly Asp Ser Val Thr Val Ala Pro Ala Leu Thr Leu Thr Asp Arg Glu
250                  255                  260                  265
ttc cag aag atg cgc gat cag ggt atc gcc atc atc cgc gag gtc ggc   2312
Phe Gln Lys Met Arg Asp Gln Gly Ile Ala Ile Ile Arg Glu Val Gly
                270                  275                  280
gtg gac acc ggt gga tgt aac atc cag ttc gct atc aac cca gtt gat   2360
Val Asp Thr Gly Gly Cys Asn Ile Gln Phe Ala Ile Asn Pro Val Asp
                285                  290                  295
ggc cgc atc atc acc att gag atg aac cca cgt gtg tct cgt tcc tcc   2408
Gly Arg Ile Ile Thr Ile Glu Met Asn Pro Arg Val Ser Arg Ser Ser
                300                  305                  310
gcg ctg gca tcc aag gca acg ggc ttc cca att gcc aag atg gct gcc   2456
Ala Leu Ala Ser Lys Ala Thr Gly Phe Pro Ile Ala Lys Met Ala Ala
                315                  320                  325
aag ctg gct atc gga tac acc ctg gat gag atc acc aac gac atc act   2504
Lys Leu Ala Ile Gly Tyr Thr Leu Asp Glu Ile Thr Asn Asp Ile Thr
330                  335                  340                  345
ggt gaa acc cca gct gcg ttt gag ccc acc atc gac tac gtc gtg gtc   2552
Gly Glu Thr Pro Ala Ala Phe Glu Pro Thr Ile Asp Tyr Val Val Val
                350                  355                  360
aag gcc cca cgc ttt gct ttc gag aag ttt gtc ggc gct gat gac act   2600
Lys Ala Pro Arg Phe Ala Phe Glu Lys Phe Val Gly Ala Asp Asp Thr
                365                  370                  375
ttg acc acc acc atg aag tcc gtc ggt gag gtc atg tcc ctg ggc cgt   2648
Leu Thr Thr Thr Met Lys Ser Val Gly Glu Val Met Ser Leu Gly Arg
                380                  385                  390
aac tac att gca gca ctg aac aag gca ctg cgt tcc ctg gaa acc aag   2696
Asn Tyr Ile Ala Ala Leu Asn Lys Ala Leu Arg Ser Leu Glu Thr Lys
                395                  400                  405
cag cag ggt ttc tgg acc aag cct gat gag ttc ttc gca ggg gag cgc   2744
Gln Gln Gly Phe Trp Thr Lys Pro Asp Glu Phe Phe Ala Gly Glu Arg
410                  415                  420                  425
gct acc gat aag gca gct gtt ctg gaa gat ctc aag cgc cca acc gaa   2792
Ala Thr Asp Lys Ala Ala Val Leu Glu Asp Leu Lys Arg Pro Thr Glu
                430                  435                  440
ggc cgc ctc tac gac gtt gag ctg gca atg cgc ctt ggc gca agc gtg   2840
Gly Arg Leu Tyr Asp Val Glu Leu Ala Met Arg Leu Gly Ala Ser Val
                445                  450                  455
gaa gaa ctc tac gaa gca tct tct att gat cct tgg ttc ctc gcc gag   2888
Glu Glu Leu Tyr Glu Ala Ser Ser Ile Asp Pro Trp Phe Leu Ala Glu
                460                  465                  470
ctt gaa gct ctc gtg cag ttc cgc cag aag ctc gtt gac gca cca ttc   2936
Leu Glu Ala Leu Val Gln Phe Arg Gln Lys Leu Val Asp Ala Pro Phe
                475                  480                  485
ctc aac gaa gat ctc ctg cgc gaa gca aag ttc atg ggt ctg tcc gac   2984
Leu Asn Glu Asp Leu Leu Arg Glu Ala Lys Phe Met Gly Leu Ser Asp
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                490               495                   500                     505
ctg  cag atc gca gcc ctt cgc cca gag ttc gct ggc gaa gac ggc gta   3032
Leu Gln Ile Ala Ala Leu Arg Pro Glu Phe Ala Gly Glu Asp Gly Val
                     510               515               520
cgc acc ttg cgt ctg tcc cta ggc atc cgc cca gta ttc aag act gtg   3080
Arg Thr Leu Arg Leu Ser Leu Gly Ile Arg Pro Val Phe Lys Thr Val
                     525               530               535
gat acc tgt gca gca gag ttt gaa gct aag act ccg tac cac tac tcc   3128
Asp Thr Cys Ala Ala Glu Phe Glu Ala Lys Thr Pro Tyr His Tyr Ser
                     540               545               550
gca tac gag ctg gat cca gca gct gag tct gag gtc gca cca cag act   3176
Ala Tyr Glu Leu Asp Pro Ala Ala Glu Ser Glu Val Ala Pro Gln Thr
                     555               560               565
gag cgt gaa aag gtc ctg atc ttg ggc tcc ggt cca aac cgc atc ggc   3224
Glu Arg Glu Lys Val Leu Ile Leu Gly Ser Gly Pro Asn Arg Ile Gly
570               575               580               585
cag ggc atc gag ttc gac tat tcc tgt gtt cac gca gct ctt gag ctc   3272
Gln Gly Ile Glu Phe Asp Tyr Ser Cys Val His Ala Ala Leu Glu Leu
                     590               595               600
tcc cgc gtc ggc tac gaa act gtc atg gtc aac tgc aac cca gag acc   3320
Ser Arg Val Gly Tyr Glu Thr Val Met Val Asn Cys Asn Pro Glu Thr
                     605               610               615
gtg tcc acc gac tac gac acc gct gac cgc ctg tac ttc gag cca ctg   3368
Val Ser Thr Asp Tyr Asp Thr Ala Asp Arg Leu Tyr Phe Glu Pro Leu
                     620               625               630
acc ttc gaa gac gtc atg gag gtc tac cac gct gag gcg cag tcc ggc   3416
Thr Phe Glu Asp Val Met Glu Val Tyr His Ala Glu Ala Gln Ser Gly
                     635               640               645
acc gtc gca ggt gtt atc gtc cag ctt ggt ggc cag act cct ctg ggc   3464
Thr Val Ala Gly Val Ile Val Gln Leu Gly Gly Gln Thr Pro Leu Gly
650               655               660               665
ttg gca gat cgt ttg aag aag gct ggc gtc cct gtc att ggt acc tcc   3512
Leu Ala Asp Arg Leu Lys Lys Ala Gly Val Pro Val Ile Gly Thr Ser
                     670               675               680
cca gag gca atc gac atg gct gag gac cgt ggc gag ttc ggt gca ctg   3560
Pro Glu Ala Ile Asp Met Ala Glu Asp Arg Gly Glu Phe Gly Ala Leu
                     685               690               695
ctg aac cgc gag cag ctt cct ggt cca gca ttc ggc acc gca acc tct   3608
Leu Asn Arg Glu Gln Leu Pro Ala Pro Ala Phe Gly Thr Ala Thr Ser
                     700               705               710
ttc gaa gag gct cgc aca gta gcc gat gag atc agc tac cca gtg ctg   3656
Phe Glu Glu Ala Arg Thr Val Ala Asp Glu Ile Ser Tyr Pro Val Leu
                     715               720               725
gtt cgc cct tcc tac gtc ttg ggt ggc cgt ggc atg gag att gtc tac   3704
Val Arg Pro Ser Tyr Val Leu Gly Gly Arg Gly Met Glu Ile Val Tyr
730               735               740               745
gat gag gct tcc ctc gag gat tac atc aac cgc gca act gag ttg tct   3752
Asp Glu Ala Ser Leu Glu Asp Tyr Ile Asn Arg Ala Thr Glu Leu Ser
                     750               755               760
tct gac cac cca gtg ctg gtt gac cgc ttc ctg gac aac gct att gag   3800
Ser Asp His Pro Val Leu Val Asp Arg Phe Leu Asp Asn Ala Ile Glu
                     765               770               775
atc gac gtc gac gca ctg tgc gac ggc gac gaa gtc tac ctg gcg ggc   3848
Ile Asp Val Asp Ala Leu Cys Asp Gly Asp Glu Val Tyr Leu Ala Gly
                     780               785               790
gtc atg gaa cac atc gag gaa gcc ggc att cac tcc ggt gac tcc gca   3896
Val Met Glu His Ile Glu Glu Ala Gly Ile His Ser Gly Asp Ser Ala
                     795               800               805
tgt gca ctt cct cca atg act ttg ggc gca cag gac atc gag aag gtc   3944
Cys Ala Leu Pro Pro Met Thr Leu Gly Ala Gln Asp Ile Glu Lys Val
810               815               820               825
cgc gaa gca acc aag aag ctg gct ctg ggc atc ggc gta cag ggc ctg   3992
Arg Glu Ala Thr Lys Lys Leu Ala Leu Gly Ile Gly Val Gln Gly Leu
                     830               835               840
atg aac gtc cag tac gca ctc aag gac gac atc ctc tac gtc atc gag   4040
Met Asn Val Gln Tyr Ala Leu Lys Asp Asp Ile Leu Tyr Val Ile Glu
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33

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                   845                    850                    855
    gca .aac cca cgt gca tcc cgc acc gtg ccg ttc gtc tcc aag gca acg      4088
  . Ala Asn Pro Arg Ala Ser Arg Thr Val Pro Phe Val Ser Lys Ala Thr
                   860                    865                    870
    ggc gtc aac ctg gcc aag gca gca tcc cgt atc gca gtg ggc gcc acc      4136
    Gly Val Asn Leu Ala Lys Ala Ala Ser Arg Ile Ala Val Gly Ala Thr
                   875                    880                    885
    atc aag gat ctc caa gat gag ggc atg att cct acc gag tac gac ggc      4184
    Ile Lys Asp Leu Gln Asp Glu Gly Met Ile Pro Thr Glu Tyr Asp Gly
    890                    895                    900                    905
    ggc tcc ttg cca ctg gac gct cca atc gct gtg aag gaa gca gtg ttg      4232
    Gly Ser Leu Pro Leu Asp Ala Pro Ile Ala Val Lys Glu Ala Val Leu
                   910                    915                    920
    ccg ttc aac cgc ttc cgt cgc cca gat gga aag acc ctg gac acc ctg      4280
    Pro Phe Asn Arg Phe Arg Arg Pro Asp Gly Lys Thr Leu Asp Thr Leu
                   925                    930                    935
    ctt tcc cca gag atg aag tcc act ggc gag gtc atg ggc ttg gcc aac      4328
    Leu Ser Pro Glu Met Lys Ser Thr Gly Glu Val Met Gly Leu Ala Asn
                   940                    945                    950
    aac ttc ggc gct gca tat gca aag gct gaa gct ggc gcg ttt ggt gca      4376
    Asn Phe Gly Ala Ala Tyr Ala Lys Ala Glu Ala Gly Ala Phe Gly Ala
                   955                    960                    965
    ttg cca acc gaa ggc acc gtc ttc gtg acc gtg gct aac cgc gac aag      4424
    Leu Pro Thr Glu Gly Thr Val Phe Val Thr Val Ala Asn Arg Asp Lys
    970                    975                    980                    985
    cgc acc ctg atc ctg cca atc cag cgc ctg gcg tcg atg ggc tac aag      4472
    Arg Thr Leu Ile Leu Pro Ile Gln Arg Leu Ala Ser Met Gly Tyr Lys
                   990                    995                    1000
    atc ctc gcc acc gaa ggc acc gca ggc atg ctg cgc cgc aac ggc att      4520
    Ile Leu Ala Thr Glu Gly Thr Ala Gly Met Leu Arg Arg Asn Gly Ile
                   1005                   1010                   1015
    gat tgt gaa gtt gtg ctc aag gct tcc gac atc cgc gaa ggt gta gag      4568
    Asp Cys Glu Val Val Leu Lys Ala Ser Asp Ile Arg Glu Gly Val Glu
                   1020                   1025                   1030
    ggc aag tcc atc gtg gat cgt atc cgc gaa ggc gaa gtt gac ctc atc      4616
    Gly Lys Ser Ile Val Asp Arg Ile Arg Glu Gly Glu Val Asp Leu Ile
                   1035                   1040                   1045
    ctc aac acc cca gct ggt tct gct ggc gct cgc cac gat ggc tac gat      4664
    Leu Asn Thr Pro Ala Gly Ser Ala Gly Ala Arg His Asp Gly Tyr Asp
    1050                   1055                   1060                   1065
    atc cgc gca gca gca gtg acc gtg ggt gtt cca ctg atc acc act gtc      4712
    Ile Arg Ala Ala Ala Val Thr Val Gly Val Pro Leu Ile Thr Thr Val
                   1070                   1075                   1080
    cag ggt gtc acc gca gct gtc cag ggc att gag gcc ctg cgt gag ggc      4760
    Gln Gly Val Thr Ala Ala Val Gln Gly Ile Glu Ala Leu Arg Glu Gly
                   1085                   1090                   1095
    gtt gtc agc gtc cgc gcg ctg cag gaa ctc gac cac gca gtc aag gct      4808
    Val Val Ser Val Arg Ala Leu Gln Glu Leu Asp His Ala Val Lys Ala
                   1100                   1105                   1110
    taagccctat gacattcggc gagaagctt                                        4837
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<210> SEQ ID NO 2
<211> LENGTH: 393
<212> TYPE: PRT
<213> ORGANISM: Brevibacterium lactofermentum
<400> SEQUENCE: 2

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    Val Pro Ala Tyr Leu Val Leu Ala Asp Gly Arg Thr Phe Thr Gly Phe
                   20                   25                   30
    Gly Phe Gly Ala Ile Gly Thr Thr Leu Gly Glu Ala Val Phe Thr Thr
                   35                   40                   45
    Ala Met Thr Gly Tyr Gln Glu Thr Met Thr Asp Pro Ser Tyr His Arg
    50                   55                   60
    Gln Ile Val Val Ala Thr Ala Pro Gln Ile Gly Asn Thr Gly Trp Asn
    65                   70                   75                   80
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Asp Glu Asp Asn Glu Ser Arg Asp Gly Lys Ile Trp Val Ala Gly Leu
              85                  90                      95
Val Ile Arg Asp Leu Ala Ala Arg Val Ser Asn Trp Arg Ala Thr Thr
            100                 105                 110
Ser Leu Gln Gln Glu Met Ala Asp Gln Gly Ile Val Gly Ile Gly Gly
            115                 120                 125
Ile Asp Thr Arg Ala Leu Val Arg His Leu Arg Asn Glu Gly Ser Ile
        130                 135                 140
Ala Ala Gly Ile Phe Ser Gly Ala Asp Ala Gln Arg Pro Val Glu Glu
145                 150                 155                 160
Leu Val Glu Ile Val Lys Asn Gln Pro Ala Met Thr Gly Ala Asn Leu
                165                 170                 175
Ser Val Glu Val Ser Ala Asp Glu Thr Tyr Val Ile Glu Ala Glu Gly
            180                 185                 190
Glu Glu Arg His Thr Val Val Ala Tyr Asp Leu Gly Ile Lys Gln Asn
            195                 200                 205
Thr Pro Arg Arg Phe Ser Ala Arg Gly Val Arg Thr Val Ile Val Pro
    210                 215                 220
Ala Glu Thr Pro Leu Glu Asp Ile Lys Gln Tyr Asn Pro Ser Gly Val
225                 230                 235                 240
Phe Ile Ser Asn Gly Pro Gly Asp Pro Ala Ala Ala Asp Val Met Val
                245                 250                 255
Asp Ile Val Arg Glu Val Leu Glu Ala Asp Ile Pro Phe Phe Gly Ile
            260                 265                 270
Cys Phe Gly Asn Gln Ile Leu Gly Arg Ala Phe Gly Met Glu Thr Tyr
            275                 280                 285
Lys Leu Lys Phe Gly His Arg Gly Ile Asn Val Pro Val Lys Asn His
        290                 295                 300
Ile Thr Gly Lys Ile Asp Ile Thr Ala Gln Asn His Gly Phe Ala Leu
305                 310                 315                 320
Lys Gly Glu Ala Gly Gln Glu Phe Glu Thr Asp Phe Gly Thr Ala Ile
            325                 330                 335
Val Thr His Thr Cys Leu Asn Asp Gly Val Val Glu Gly Val Ala Leu
            340                 345                 350
Lys Ser Gly Arg Ala Tyr Ser Val Gln Tyr His Pro Glu Ala Ala Ala
            355                 360                 365
Gly Pro Asn Asp Ala Ser Pro Leu Phe Asp Gln Phe Val Glu Leu Met
    370                 375                 380
Asp Ala Asp Ala Gln Lys Lys Gly Ala
385                 390
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<210>  SEQ ID NO 3
<211>  LENGTH: 1113
<212>  TYPE: PRT
<213>  ORGANISM: Brevibacterium lactofermentum
<400>  SEQUENCE: 3
       Met Pro Lys Arg Ser Asp Ile Asn His Val Leu Val Ile Gly Ser Gly
        1               5                  10                  15
       Pro Ile Val Ile Gly Gln Ala Cys Glu Phe Asp Tyr Ser Gly Thr Gln
                    20                  25                  30
       Ala Cys Arg Val Leu Lys Glu Glu Gly Leu Arg Val Thr Leu Ile Asn
                35                  40                  45
       Ser Asn Pro Ala Thr Ile Met Thr Asp Pro Glu Met Ala Asp His Thr
            50                  55                  60
       Tyr Val Glu Pro Ile Glu Pro Glu Tyr Ile Asp Lys Ile Phe Ala Lys
       65                  70                  75                  80
       Glu Ile Glu Gln Gly His Pro Ile Asp Ala Val Leu Ala Thr Leu Gly
                    85                  90                  95
       Gly Gln Thr Ala Leu Asn Ala Ala Ile Gln Leu Asp Arg Leu Gly Ile
                   100                 105                 110
       Leu Glu Lys Tyr Gly Val Glu Leu Ile Gly Ala Asp Ile Asp Ala Ile
                   115                 120                 125
       Glu Arg Gly Glu Asp Arg Gln Lys Phe Lys Asp Ile Val Thr Thr Ile
            130                 135                 140
       Gly Gly Glu Ser Ala Arg Ser Arg Val Cys His Asn Met Asp Glu Val
       145                 150                 155                 160
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His Glu Thr Val Ala Glu Leu Gly Leu Pro Val Val Val Arg Pro Ser
             165             170             175
Phe Thr Met Gly Gly Leu Gly Ser Gly Leu Ala Tyr Asn Thr Glu Asp
         180             185             190
Leu Glu Arg Ile Ala Gly Gly Gly Leu Ala Ala Ser Pro Glu Ala Asn
         195             200             205
Val Leu Ile Glu Glu Ser Ile Leu Gly Trp Lys Glu Phe Glu Leu Glu
     210             215             220
Leu Met Arg Asp Thr Ala Asp Asn Val Val Val Ile Cys Ser Ile Glu
225             230             235             240
Asn Val Asp Ala Leu Gly Val His Thr Gly Asp Ser Val Thr Val Ala
             245             250             255
Pro Ala Leu Thr Leu Thr Asp Arg Glu Phe Gln Lys Met Arg Asp Gln
             260             265             270
Gly Ile Ala Ile Ile Arg Glu Val Gly Val Asp Thr Gly Gly Cys Asn
         275             280             285
Ile Gln Phe Ala Ile Asn Pro Val Asp Gly Arg Ile Ile Thr Ile Glu
     290             295             300
Met Asn Pro Arg Val Ser Arg Ser Ser Ala Leu Ala Ser Lys Ala Thr
305             310             315             320
Gly Phe Pro Ile Ala Lys Met Ala Ala Lys Leu Ala Ile Gly Tyr Thr
         325             330             335
Leu Asp Glu Ile Thr Asn Asp Ile Thr Gly Glu Thr Pro Ala Ala Phe
         340             345             350
Glu Pro Thr Ile Asp Tyr Val Val Val Lys Ala Pro Arg Phe Ala Phe
         355             360             365
Glu Lys Phe Val Gly Ala Asp Asp Thr Leu Thr Thr Thr Met Lys Ser
         370             375             380
Val Gly Glu Val Met Ser Leu Gly Arg Asn Tyr Ile Ala Ala Leu Asn
385             390             395             400
Lys Ala Leu Arg Ser Leu Glu Thr Lys Gln Gln Gly Phe Trp Thr Lys
             405             410             415
Pro Asp Glu Phe Phe Ala Gly Glu Arg Ala Thr Asp Lys Ala Ala Val
             420             425             430
Leu Glu Asp Leu Lys Arg Pro Thr Glu Gly Arg Leu Tyr Asp Val Glu
         435             440             445
Leu Ala Met Arg Leu Gly Ala Ser Val Glu Glu Leu Tyr Glu Ala Ser
     450             455             460
Ser Ile Asp Pro Trp Phe Leu Ala Glu Leu Glu Ala Leu Val Gln Phe
465             470             475             480
Arg Gln Lys Leu Val Asp Ala Pro Phe Leu Asn Glu Asp Leu Leu Arg
             485             490             495
Glu Ala Lys Phe Met Gly Leu Ser Asp Leu Gln Ile Ala Ala Leu Arg
             500             505             510
Pro Glu Phe Ala Gly Glu Asp Gly Val Arg Thr Leu Arg Leu Ser Leu
             515             520             525
Gly Ile Arg Pro Val Phe Lys Thr Val Asp Thr Cys Ala Ala Glu Phe
     530             535             540
Glu Ala Lys Thr Pro Tyr His Tyr Ser Ala Tyr Glu Leu Asp Pro Ala
545             550             555             560
Ala Glu Ser Glu Val Ala Pro Gln Thr Glu Arg Glu Lys Val Leu Ile
             565             570             575
Leu Gly Ser Gly Pro Asn Arg Ile Gly Gln Gly Ile Glu Phe Asp Tyr
             580             585             590
Ser Cys Val His Ala Ala Leu Glu Leu Ser Arg Val Gly Tyr Glu Thr
         595             600             605
Val Met Val Asn Cys Asn Pro Glu Thr Val Ser Thr Asp Tyr Asp Thr
     610             615             620
Ala Asp Arg Leu Tyr Phe Glu Pro Leu Thr Phe Glu Asp Val Met Glu
625             630             635             640
Val Tyr His Ala Glu Ala Gln Ser Gly Thr Val Ala Gly Val Ile Val
             645             650             655
Gln Leu Gly Gly Gln Thr Pro Leu Gly Leu Ala Asp Arg Leu Lys Lys
             660             665             670
Ala Gly Val Pro Val Ile Gly Thr Ser Pro Glu Ala Ile Asp Met Ala
             675             680             685
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Glu Asp Arg Gly Glu Phe Gly Ala Leu Leu Asn Arg Glu Gln Leu Pro
    690                 695                 700
Ala Pro Ala Phe Gly Thr Ala Thr Ser Phe Glu Glu Ala Arg Thr Val
705                 710                 715                 720
Ala Asp Glu Ile Ser Tyr Pro Val Leu Val Arg Pro Ser Tyr Val Leu
                725                 730                 735
Gly Gly Arg Gly Met Glu Ile Val Tyr Asp Glu Ala Ser Leu Glu Asp
                740                 745                 750
Tyr Ile Asn Arg Ala Thr Glu Leu Ser Ser Asp His Pro Val Leu Val
            755                 760                 765
Asp Arg Phe Leu Asp Asn Ala Ile Glu Ile Asp Val Asp Ala Leu Cys
770                 775                 780
Asp Gly Asp Glu Val Tyr Leu Ala Gly Val Met Glu His Ile Glu Glu
785                 790                 795                 800
Ala Gly Ile His Ser Gly Asp Ser Ala Cys Ala Leu Pro Pro Met Thr
            805                 810                 815
Leu Gly Ala Gln Asp Ile Glu Lys Val Arg Glu Ala Thr Lys Lys Leu
            820                 825                 830
Ala Leu Gly Ile Gly Val Gln Gly Leu Met Asn Val Gln Tyr Ala Leu
            835                 840                 845
Lys Asp Asp Ile Leu Tyr Val Ile Glu Ala Asn Pro Arg Ala Ser Arg
    850                 855                 860
Thr Val Pro Phe Val Ser Lys Ala Thr Gly Val Asn Leu Ala Lys Ala
865                 870                 875                 880
Ala Ser Arg Ile Ala Val Gly Ala Thr Ile Lys Asp Leu Gln Asp Glu
                885                 890                 895
Gly Met Ile Pro Thr Glu Tyr Asp Gly Gly Ser Leu Pro Leu Asp Ala
            900                 905                 910
Pro Ile Ala Val Lys Glu Ala Val Leu Pro Phe Asn Arg Phe Arg Arg
            915                 920                 925
Pro Asp Gly Lys Thr Leu Asp Thr Leu Leu Ser Pro Glu Met Lys Ser
    930                 935                 940
Thr Gly Glu Val Met Gly Leu Ala Asn Asn Phe Gly Ala Ala Tyr Ala
945                 950                 955                 960
Lys Ala Glu Ala Gly Ala Phe Gly Ala Leu Pro Thr Glu Gly Thr Val
                965                 970                 975
Phe Val Thr Val Ala Asn Arg Asp Lys Arg Thr Leu Ile Leu Pro Ile
            980                 985                 990
Gln Arg Leu Ala Ser Met Gly Tyr Lys Ile Leu Ala Thr Glu Gly Thr
    995                 1000                1005
Ala Gly Met Leu Arg Arg Asn Gly Ile Asp Cys Glu Val Val Leu Lys
    1010                1015                1020
Ala Ser Asp Ile Arg Glu Gly Val Glu Gly Lys Ser Ile Val Asp Arg
1025                1030                1035                1040
Ile Arg Glu Gly Glu Val Asp Leu Ile Leu Asn Thr Pro Ala Gly Ser
            1045                1050                1055
Ala Gly Ala Arg His Asp Gly Tyr Asp Ile Arg Ala Ala Ala Val Thr
            1060                1065                1070
Val Gly Val Pro Leu Ile Thr Thr Val Gln Gly Val Thr Ala Ala Val
    1075                1080                1085
Gln Gly Ile Glu Ala Leu Arg Glu Gly Val Val Ser Val Arg Ala Leu
    1090                1095                1100
Gln Glu Leu Asp His Ala Val Lys Ala
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